Mammographic Detection of Early Breast Cancer

Ten Years' Experience in a Community Hospital

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Mammography is currently the most effective method for detecting early breast cancer. In one community hospital during the decade 1974 through 1983, 35% of 415 cases of breast cancer were discovered by xeromammography alone, with a false-positive interpretation rate of 65% and a false-negative rate of 11.1%. Mammography was responsible for detecting an increasing number of smaller cancers with fewer axillary metastases. Such lesions have the most favorable five- and ten-year survival rates. Much lower detection rates of preclinical breast cancer have been reported from other community hospitals.

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Breast cancer will develop in 9% of American women in their lifetime. Accumulating evidence suggests that the previously stable rates of mortality from breast cancer can be improved by early detection. Ten-year survival rates exceeding 95% have been reported in patients with excised early lesions.[1,2] Presently, mammography represents the most effective, accurate and reliable method for detecting breast cancer in its early stages.

Mammography alone accounted for 41.6% of all cancers found in the joint American Cancer Society and National Cancer Institute Breast Cancer Detection and Demonstration Project.[3] Among the 3,557 cases of cancer discovered, 59% of the noninfiltrating lesions were found by mammography alone, as were 52.6% of minimal cancers (in situ carcinoma and invasive malignant tumors of less than 1 cm in diameter).

For the benefits of early detection and improved survival to reach the largest number of American women, community hospitals and general radiologists must become widely and actively involved in providing quality mammographic services. While the efficacy of breast cancer detection programs at academic and dedicated centers has been amply documented, reported experience at community hospitals has been limited.[4-8]

Children's Hospital of San Francisco is a 320-bed general medical and surgical hospital oriented toward providing medical care to women and children. A dedicated mammographic machine was acquired in November 1973 and shortly thereafter a mammographic-pathologic data-collection program was begun. Six general radiologists interpreted about equal numbers of xeromammograms after each had attended an instructional course. Consultation among radiologists occurred freely, particularly for interesting or problem cases. A formal, uniform program for double reading examinations was not used. Clinical information supplied by a referring clinician or examination technologist was available in nearly all cases. We report the cumulative experience during the ten years from January 1, 1974, to December 31, 1983.

Mammographic-Pathologic Correlation

Mammographic examinations were done with a dedicated breast-imaging unit (General Electric MMX) and the Xerox 125 processing system. Compression craniocaudal, recumbent contact mediolateral and tunnel (sponge lateral) projections were taken routinely. Except for breasts with prosthetic implants, positive-mode xeroradiographic imaging was used. A three-month trial of negative-mode xeroradiography was abandoned in 1978 due to technologist and radiologist dissatisfaction. Additional aluminum filtration was added to the unit in 1977 and 1979, so that midplane absorbed breast doses were about 0.5 rads per exposure for the average 5- to 6-cm compressed breast.

On a monthly basis, the mammograms of all patients undergoing breast biopsy or mastectomy were reviewed and correlated with surgical and microscopic pathology findings. In 1974, a surgical pathologist (M.D.L.) initiated a comprehensive protocol to study all surgically removed breast tissue. This included whole-breast specimen radiography, serial subgross sectioning and radiography of individual specimen

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slices, followed by extensive histologic sampling with particular attention to areas appearing suspicious on specimen radiographs.

Cases of particular interest or difficulty were reviewed at monthly radiologic-pathologic correlation conferences attended by pathologists, radiologists and mammographic technologists.

In all, 13,316 xeromammographic examinations were done during the ten-year period. Most patients studied were symptomatic. In the last five years of the decade, screening mammograms constituted a progressively increasing proportion of examinations.

Biopsy or mastectomy material was available for review in 1,356 cases, including 415 of breast cancer. Table 1 presents comparative data for 16-month periods early and late in the study decade. The histology of breast tissue of only patients with preoperative mammograms was included.

Although the number of mammographic examinations increased between 1974 and 1983, an appreciable decrease in examination volume occurred from 1976 through 1978, largely related to the widespread public fear of radiation-induced breast cancer. The number of breast biopsies done increased progressively during the ten-year period. About a third of such biopsies yielded breast cancer and this proportion of biopsies with abnormal results ("positive") remained relatively stable throughout the decade. A more than sixfold increase in cases of noninvasive breast cancer during the ten years is notable. These cancer cases were typically those found by mammographic examination.

Mammographic Versus Clinical Detection of Breast Cancer

During the study decade, mammography alone was responsible for detecting 35% of 415 cases of breast cancer. The increasing contribution of mammography to the overall detection of breast cancer in our patients is presented in Table 2. The number of malignant lesions detected by mammography alone increased from 14% in 1974-1975 to 41% in 1983, the tenth year of collecting data. Increasing observer and technologist experience likely account for this progressive increase in the effectiveness of mammography in detecting nonpalpable cancers.

TABLE 1.—*Comparative Data at the Beginning and End of the Study Decade*

Results of Mammography	1974-1975	1982-1983
Patients examined	1,144	2,064
Breast biopsies	87	198
Number of cancers	29	71
Average size, mm	40	20.5
Clinically occult, %	14	41
Noninvasive, %	5	31

TABLE 2.—*Detecting Clinically Occult Cancers*

Year	Cancers Found By Mammography Alone Percent
1974-1975	14
1976-1977	27
1978-1980	34
1982-1983	41

TABLE 3.—*Needle Localization of 317 Nonpalpable Lesions*

Abnormality	Lesions Localized Number	Malignant Number	Malignant Percent
Suspicious calcifications	187	59	31.6
Discrete mass without calcifications	44	10	22.7
Suspicious area without calcifications	86	21	24.4

TABLE 4.—*Axillary Node Metastases in 415 Cases of Breast Cancer*

Patients	Occult Cancer, N = 145 Number	(Percent)	Palpable Cancer, N=270 Number	(Percent)
Nodes removed	51	(35)	197	(73)
Nodes positive	7	(14)	89	(45)

Beginning in 1974, a needle-localizing technique was used to guide the excision of mammographically suspicious lesions. Standard 25-gauge needles are placed into a suspicious area and 0.1 to 0.2 ml of methylene blue is injected when the area is satisfactorily located. The patient is then sent to the surgical suite with the needle taped in place. The surgeon can use both the position of the needle tip and the methylene blue-stained tissue to guide excisional biopsy. Specimen radiography is then routinely done to assess the adequacy of tissue removal. This simple system has worked extremely well and, although more complex and sophisticated localizing systems have been described, we have not found them necessary. With some experience, a typical localization procedure is completed in 15 minutes with no significant patient discomfort.

The indications for and the results of 317 needle localization procedures are given in Table 3.

Axillary Node Metastases

Malignant tumors detected by mammography alone were considerably smaller than palpable lesions and were a third less likely to have metastasized to axillary lymph nodes (Table 4).

Accuracy of Radiologic Diagnosis

Follow-up data allowing radiographic-pathologic correlation were collected only for those patients undergoing surgical biopsy or mastectomy at Children's Hospital within four months following a mammographic examination.

Mammographic interpretations were categorized as malignant or suspicious for cancer in 46.5% of 1,356 biopsied cases. Benign diagnoses were rendered radiographically in 46.2%. Efforts to reach specific and unambiguous conclusions were not always successful and indeterminate reports comprised 7.3% of examinations.

A false-positive result occurs when a positive or suspicious mammographic interpretation is reported and the findings of a subsequent biopsy of the suspect area are benign. These instances include mammographic findings that reflect clinically palpable lesions and occult mammographic abnormalities in clinically negative breasts. Throughout the ten

years of data accumulation, the number of false-positive interpretations remained relatively stable at 65% of breasts from which benign tissue was removed at biopsy.

False-Negative Examinations—Missed Lesions

False-negative examinations are mammograms interpreted as benign that were obtained within four months of a surgical diagnosis of breast cancer. This occurred in 58 (14%) of the 415 cases. Among these were 12 patients who underwent a surgical procedure for benign disease and had an isolated microscopic focus of duct or lobular carcinoma in situ without calcification discovered in the surgical specimen. If these lesions, which were not visible in retrospect and may fall below the threshold of mammographic detection, are excluded, there were 46 palpable cancers undiagnosed by mammography, for a false-negative rate of 11.1%. There was a progressive decrease in false-negative mammographic interpretations during the ten-year period from 20.5% in 1974 to 9.7% in 1983. As imaging equipment was unchanged during this period, the improvement likely resulted from increased experience among technologists and radiologists in doing and interpreting mammographic studies. About a third of the errors made were interpretive and, therefore, correctable. These included mammographic lesions that were visible but not identified and abnormalities that were described but mistakenly interpreted as benign. Of the remaining lesions missed, many were small, superficially located and easily palpable, but were not imaged or were obscured by adjacent dense breast tissue, particularly in the retroareolar areas. Deep lesions adjacent to the retromammary fascia and lesions situated medially in the parasternal area and peripherally in the axillary tail all were missed due to failure to image the lesion. Oblique, angulated and other nonstandard projections used by a technologist determined to image any palpable abnormality can decrease the number of lesions missed for this reason. Noncalcified cancers in homogeneously dense breasts and diffuse, infiltrative cellular lesions producing no desmoplastic tissue response often could not be identified on careful retrospective review. These cancers fell below the threshold of mammographic detectability for the imaging system used. Magnification and grid techniques and increasing awareness of the subtle mammographic signs of malignancy may reduce the number of mammograms falsely interpreted as negative among this group of lesions.

At the conclusion of the study decade, the hospital acquired a new, dedicated mammographic machine capable of grid and magnification film-screen and xeroradiographic imaging. Preliminary experience with this sophisticated equipment has been positive. It is considered likely that more early cancers will be identified in studies done with this equipment.

Discussion

The favorable impact of mammography upon the early detection of breast cancer has been amply documented.[1,3,9,10] Mammography is the only imaging technique with a proved capability for detecting a clinically occult malignant lesion in an early stage. The 29 Breast Cancer Detection Demonstration Project centers screened about 275,000 women nationally between 1973 and 1980. Of the 3,557 cancers detected, 41.6% were found only by mammography. Dedicated mammographic facilities and university centers have had similar success in detecting occult breast malignancy.

Reports from community hospitals have been sparse, with detection rates for nonpalpable cancers of 30%,[5] 21%,[4] 5%[6] and less than 3%.[7,8]

In a recent survey of occult breast cancer detection in 11 community hospitals,[8] 2,960 breast cancers were recorded in tumor registries between 1975 and 1982. Only 68 of these (2.3%) were detected mammographically, with no hospital reporting a preclinical detection rate of more than 12.5% in any of the years surveyed. These data suggest that the rate of detecting early breast cancer in community hospitals can be substantially improved. The acquisition of modern, dedicated mammographic equipment by hospital radiology departments, and the education and training of hospital radiologists are essential to this effort. Mammographic interpretive skills and diagnostic accuracy can be improved by the establishment of a process by which mammographic findings are regularly and carefully correlated with the findings of gross and microscopic pathology.

Awareness of the potential benefit of early breast cancer detection and cooperative efforts among primary care physicians, surgeons, pathologists and radiologists dedicated to the improvement of breast cancer survival statistics in their community can extend this benefit to an increasingly larger number of women.

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